Variable force camera control

FIELD OF THE INVENTION

The present invention relates generally to photography.

SUMMARY OF THE INVENTION

A camera is adjustable such that the force required to actuate one or more of the camera's controls can be changed by a camera user.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts a typical camera.

Figure 2A depicts a shutter release in accordance with an example embodiment of the invention, in a first adjusted position.

Figure 2B depicts the shutter release in a second adjusted position.

Figure 3 depicts a shutter release in accordance with a second example embodiment of the invention.

Figure 4 illustrates a schematic block diagram of a portion of a camera in accordance with an example embodiment of the invention.

Figure 5 shows a back view of a camera with several controls.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 depicts a typical camera **100**, which may be a digital camera or a film camera. Camera **100** uses a lens **101** to collect light emanating from a scene, and redirects the collected light to project an image of the scene on a light-sensitive element. The light sensitive element may be photographic film in the case that

camera **100** is a film camera, or may be an electronic sensor in the case that camera **100** is a digital camera.

A user of the camera instigates the taking of a photograph by depressing a shutter release button **102**. For the purposes of this disclosure a "shutter release" is a camera control that causes a photograph to be taken, whether or not the camera actually comprises a mechanical shutter or performs the equivalent function electronically.

Figure 2A depicts a cutaway view of camera **100**, showing a shutter release **200** in accordance with an example embodiment of the invention. Shutter release button **201** is attached to or integral with stepped shaft **202**. Stepped shaft **202** further comprises a threaded portion **203** and an unthreaded distal end **204**. Snap ring **205** constrains shutter release button **201** in camera body **206**. Compression spring **207** exerts an upward force on shutter button **201** by pressing against threaded square nut **208**. Unthreaded distal end **204** of shutter release button **201** is near switch **209** mounted on circuit board **210**.

The camera user operates shutter release **200** by moving shutter release button **201** downward, usually using an index finger, until unthreaded distal end **204** encounters switch **209**. Switch **209** may be a mechanical switch, capacitive switch, hall-effect device, or another kind of device that can detect the arrival of distal end **204** of shutter button **201**. Switch **209** may provide one or more signals to a camera control unit (not shown) when shutter button **201** is actuated, indicating the downward progress of shutter button **201**.

In the configuration shown in Figure 2A, compression spring **207** is relatively unstressed, and exerts a relatively small upward force on shutter release button **201**. For example, compression spring **207** may exert an upward force of 10 grams on

shutter release button **201** when in the position shown in Figure 2A, before actuation has begun. When shutter release **200** is configured as shown in Figure 2A, the camera user can actuate it, thereby causing camera **100** to take a photograph, with relatively little force. The camera user may prefer this configuration due to personal taste, or for a particular photographic situation, such as delicate studio photography. In the configuration of Figure 2A, relatively little force is imparted on camera **100** during the taking of a photograph, and correspondingly little camera motion may result.

Shutter release **200** is adjustable. Referring to Figure 2B, when shutter release button **201** is rotated counterclockwise (as viewed from the top) about its axis of rotation **213**, threaded square nut **208**, by virtue of being constrained from rotation by rectangular recess **301**, travels downward along threaded portion **203** of stepped shaft **202**. In the process, compression spring **207** is compressed, and exerts increasing upward force on shutter button **201** in proportion to the travel of threaded square nut **208**. For example, if compression spring **208** has a spring constant of 10 grams per millimeter, then for each millimeter threaded square nut **208** travels downward, the upward force exerted on shutter button **201** increases by 10 grams. Using the example figures so far given, if threaded square nut **208** travels downward by 5 millimeters, then the upward force on shutter release button **201** will be 60 grams, before actuation is begun. These figures are given by way of example only; other selections of travel and spring stiffness may be used. Second snap ring **211** (visible only in Figure 2A) prevents threaded square nut **208** from traveling so far down threaded portion **203** that compression spring **207** can no longer provide enough compliance for distal end **204** to reach switch **209**.

In the configuration of Figure 2B, relatively more force is required to depress shutter release button **201**. A camera user may prefer this configuration, or an

intermediate one, due to personal taste or for use in a particular photographic situation. For example, on a photo safari, camera **100** may be subjected to much vibration and rough handling. Having a shutter release **200** that requires relatively more force for actuation may prevent accidental triggering of camera **100**.

Turning shutter release button **201** in the opposite direction lengthens spring **207**, thereby reducing the force with which it resists the actuation of shutter release button **201**.

Figure 3 depicts a shutter release **300** in accordance with a second example embodiment of the invention. Shutter release button **301** is attached to or integral with stepped shaft **302**. Wave spring **303** exerts a modest upward force on shutter release button **301**. Snap ring **304** constrains shutter release button **301** to camera body **305**. Ring magnet **306** is fixedly attached to stepped shaft **302**, and produces magnetic flux in the vertical direction. Distal end **307** of stepped shaft **302** is near switch **308**, which is mounted on circuit board **309**. The operation of switch **308** may be similar to the operation of switch **209** previously described.

Wire coil **310** is mounted on circuit board **309** immediately below ring magnet **306**. When electric current is passed through wire coil **310**, magnetic flux is generated in the vertical direction. The resulting effect is to attract or repel ring magnet **306**, and therefore also shutter release button **301**, toward or away from wire coil **310**, depending on the direction of current flow in wire coil **310** and the orientation of the poles of ring magnet **306**. The force exerted on ring magnet **306** is proportional to the magnitude of the current flowing in wire coil **310** and the strength of ring magnet **306**. The force is also inversely related to the distance between wire coil **310** and ring magnet **306**. A control circuit **401**, possibly on circuit board **309** and illustrated in Figure 4, can adjust the magnitude of the current flowing in wire coil

310. The camera may provide an appropriate user control **402** for allowing the camera user to specify a force required for actuation, or a "stiffness," for shutter release button **301**. The camera may increase the current magnitude such that an upward force is exerted on shutter release button **301**, resisting the actuation of shutter release button **301** with a force that is to the user's taste. The force specification provided by the user may be in actual units of force, such as ounces or Newtons, or may be in quantitative but uncalibrated units, such as a simple numerical scale. Alternatively, the force specification may be a qualitative indication. For example, a control may provide settings for "Heavy" and "Light" forces, or for "Hard" and "Easy" actuation, or may use other similar terms.

In addition, the control circuit **401** and user control **402** may provide for reversing the direction of the current flow through wire coil **310**, such that the magnetic force generated tends to attract shutter release button **301** toward wire coil **310**, against the resistance of wave spring **303**. This arrangement has the effect of assisting the actuation of shutter release button **301**, making shutter release button **301** easier to press, as the user may desire for a particular photographic situation.

Figure 4 illustrates a schematic block diagram of a portion of a camera in accordance with an example embodiment of the invention. A user control **402**, which may be a button, dial, switch, or other control and may involve a displayed menu, allows a user to specify an actuation force for the shutter release **300**. User control **402** signals the desired actuation force to control circuit **401**. Control circuit **401** may contain a microprocessor system, discrete electronic components, integrated circuits, or a combination of these. Control circuit **401** adjusts the current "I" flowing through wire coil **301** in accordance with the force specified by the camera user by way of user control **402**.

While a shutter release button serves as one example camera control in which the invention may be embodied, other camera controls may be adjustable as well. Figure 5 shows a back view of a camera with several buttons **501-505**. Buttons **501-505** are representative of controls that a camera user may use to adjust camera settings or operational modes. The controls may interact with menus or other information displayed on display **506**.

A camera user may wish to adjust any or all of the buttons so that the force required to actuate them is at a preferred level. The user may wish to adjust the force for a particular photographic situation, or for personal taste. Such an adjustment may additionally be useful for accommodating certain physical disabilities of the camera user. For example, if the camera user suffers from a disability that compromises fine motor control, setting the camera controls to require a relatively high actuation force can reduce the possibility of accidental actuation.

The foregoing description of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and other modifications and variations may be possible in light of the above teachings. For example, rather than compression spring **207**, an arrangement may be envisioned that uses a tension spring whose length is increased to provide increased force resisting the actuation of shutter release button **201**. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and various modifications as are suited to the particular use contemplated. It is intended that the appended claims be construed to include other alternative embodiments of the invention except insofar as limited by the prior art.